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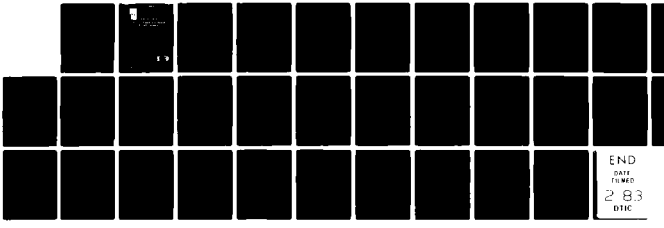

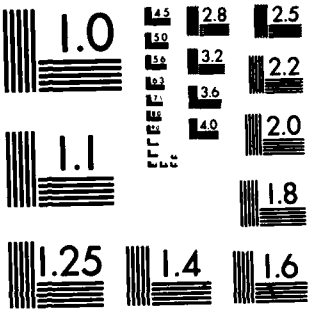

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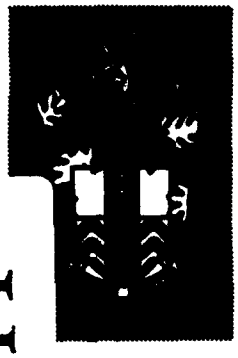

RSRE
MEMORANDUM No. 3517

ROYAL SIGNALS & RADAR ESTABLISHMENT

THE AXIS TEST BOX OPERATING GUIDE

Author: A L Simcock

PROCUREMENT EXECUTIVE,
MINISTRY OF DEFENCE,
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WORCS.

ROYAL SIGNALS AND RADAR ESTABLISHMENT

Memorandum 3517

TITLE: THE AXIS TEST BOX OPERATING GUIDE

AUTHOR: A L Simcock

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SUMMARY

This Memorandum is the Operating Guide for the microprocessor controlled test box built for Project AXIS. The operating guide is designed to be both a comprehensive step by step guide and also a 'quick reference' guide for the experienced user.

RSRE MEMORANDUM No 3517

THE AXIS TEST BOX: OPERATING GUIDE

A L Simcock

LIST OF CONTENTS

LIST OF ABBREVIATIONS

GTU	Group Terminating Unit
MMI	Man Machine Interface
CPU	Central Processor Unit
VDU	Visual Display Unit
O/P	Output
I/P	Input
CC	Check Code
RA	Register Address
Tx	Transmit
Rx	Receive
CDU	Code Detector Unit
CPC	Cyclically Permutable Code
TSU	Trunk Signalling Unit
HEX	Hexadecimal
CR	Carriage Return

NOTE: The symbol Ø is used to represent the number zero throught this memorandum so that it may easily be distinguishable from the letter O.

LIST OF FIGURES

1 INTRODUCTION

The microprocessor controlled AXIS test box has been designed to aid testing of the Group Terminating Unit and Matrix elements of the AXIS switch experiment. The test box performs all the functions of the original hardware designed test box and adds several more useful features.

This document has been written as a operating guide for the test box and as a guide to the test box MMI.

The test box will be used to stimulate and control the GTU and Matrix in place of the System 250 when all the CPU functions are not required ~~(see ref 3)~~.

1.1 Physical Description of the Test Box

The VDU is the interface between the User and the AXIS test box. There are two external switches, two BNC sockets and twelve 4 mm 'banana' type sockets. These are for connection to the system under test and for oscilloscope triggering puproses. All User interface operations are carried out via the VDU.

The twelve 4 mm sockets are for interconnection to the system under test (Ax, Dx, Tx, Ay, Dy and Ty). (See ref 1). The first switch is for selecting external or internal clock. The external clock is connected to the test box via the first BNC connector.

The external clock may be used to synchronise output and input transfers to the clock rate of the GTU or Matrix. This allows an oscilloscope to be used to test the GTU or Matrix without display jitter caused by non-synchronised output and input transfers.

The second switch is used to select an oscilloscope trigger which is output from the test box via the second BNC connector. The switch allows trigger selection for input or output transfers between the test box and the system under test.

1.2 Prompts

To ensure the User enters the correct information the AXIS test box issues prompts. Response by the User to these prompts must be correct otherwise the prompt will be rewritten by the AXIS test box until it is answered correctly, eg entering more than the required number of characters will cause "OVERFLOW" messages to be displayed followed by the prompt message.

All inputs to the test box by the User must be terminated by a carriage return. Numbers, eg block number and transmission count, will be in DECIMAL format all other numerical entries, eg Data will be in HEXADECIMAL format.

The prompts are intended to be self explanatory and are designed to guide the User through all the facilities offered by the test box.

2 FEATURES AVAILABLE

When the test box is switched on the "Basic Command" routine is entered by the microprocessor and the following prompt displayed on the VDU:

A = Assemble Message
B = Display on Request
C = Auto Display
D = Repeat
E = Display Current Menu

These five basic commands allow the User access to all of the features incorporated in the test box. After completion of a task the test box will return to the basic command mode.

2.1 Assemble Message

This series of command routines allows the User to select all the output options required to transmit messages to the GTU or Matrix and to also select the format for display of responses.

2.2 Display on Request

This series of routines enables the User to display the input messages which have been stored (as selected in 2.1 above).

2.3 Auto Display

In this routine the test box will accept autonomous input transfers from the GTU or Matrix and cause them to be stored and displayed.

2.4 Repeat

This routine allows the User to change individual parameters of a message before retransmission.

2.5 Display Current Menu

This routine will cause all the message parameters to be displayed for User inspection.

3 DESCRIPTION OF TEST BOX FACILITIES

This section describes the facilities in each of the basic commands available. They are described in the order in which the User would be expected to enter information in response to the test box prompts.

3.1 Assemble Message Facilities

When the message assembly routine has been entered by the User the test box will issue the series of prompts necessary to ensure that all the information essential is entered by the User. During message assembly all other acitivity is suspended.

3.1.1 Message Type

The test box offers several different ways of assembling messages. There are two message registers; A and B, which can be transmitted alternately or independently.

The User should enter his choice of the three types A, B or T. A = A register, B = B register, T = both registers Together. Each register occupies forty-two bits and consists of a check code, register address, data and parity.

When T is selected the A register is always the first to be transmitted and is also the first to have its contents defined by the User as entries to the test box. The B register contents are defined after the prompt "Enter input for message B"is displayed.

3.1.2 Message Format

Each message will consist of check code, Register address, Data and Parity bit(s). Three message structure formats will be incorporated, GTU, Matrix 1 and Matrix 2. In all format the O/P message length will be fixed at 42 bits.

3.1.2.1 GTU Format (see Figure 1)

The GTU format may be used for any message to the GTU or indeed, for a message to the Matrix if so desired.

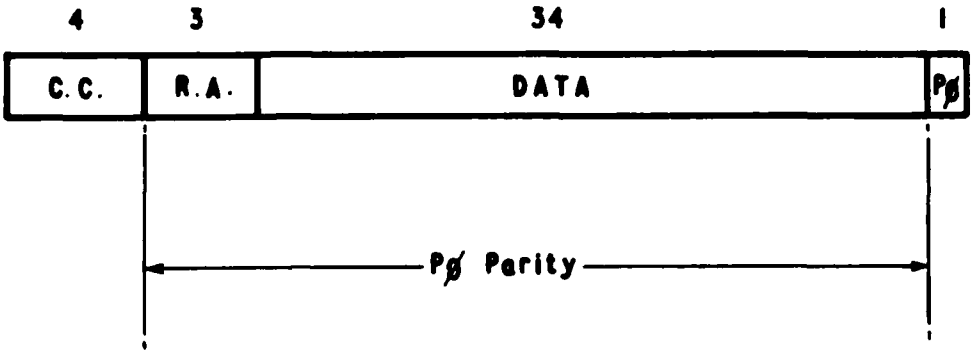


FIGURE 1 - GTU MESSAGE FORMAT

Check Code CC

Check code will occupy four bits, 38 to 41 inclusive.

Register Address RA

Register Address will occupy three bits, 35 to 37 inclusive.

Data

The data will occupy 34 bits, 1 to 34 inclusive.

Parity $P_{\emptyset}$

Parity will occupy one bit only, bit Ø.

Parity $P_{\emptyset}$ will be the even parity of Register Address and Data fields.

Parity $P_{\emptyset}$ will be generated automatically by the test box.

3.1.2.2 Matrix 1 Format

This format is specific to the Matrix Command Register (see Figure 2)

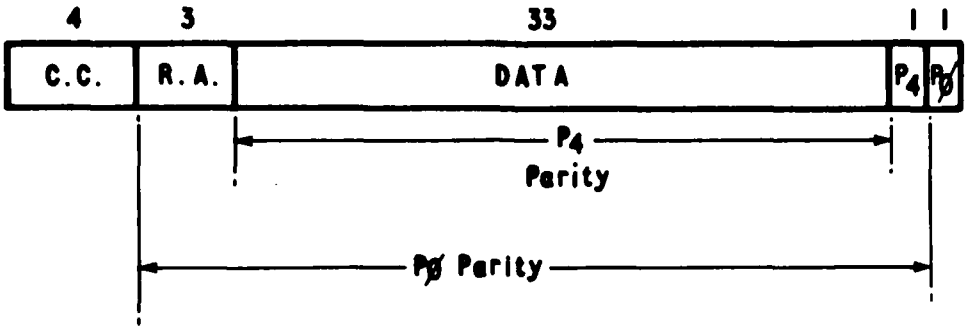


FIGURE 2 - MATRIX COMMAND REGISTER FORMAT

Check Code CC

The check code will occupy 4 bits, 38 to 41 inclusive.

Register Address RA

In order that this message format may be entered by the test box the register address must be 1 and this will be placed in a three bit field, bits 35 to 37 inclusive.

Data

The data field is restricted to 33 bits, 2 to 34 inclusive.

Parity $P_{\emptyset}$ and P_4

Two parity bits $P_{\emptyset}$ (occupying bit ∅) and P_4 (occupying bit 1) are identified in this format.

Parity bit P_4 covers all data bits in the message.

Parity bit $P_{\emptyset}$ covers Register Address, Data and P_4 as noted in Figure 2.

Both parity bits will be generated automatically by the test box.

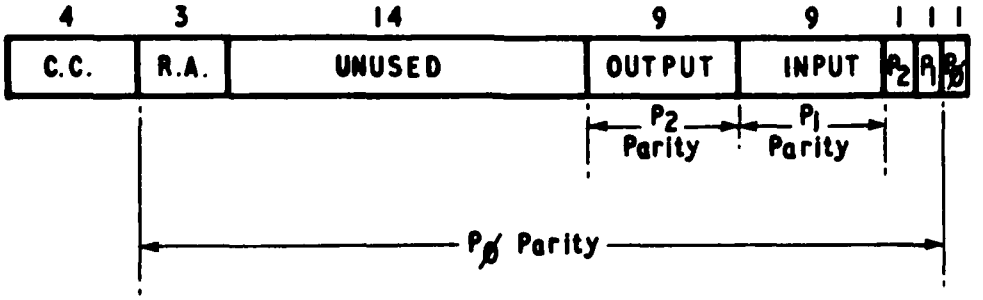


FIGURE 3 - MATRIX CONNECTION REGISTER FORMAT

3.1.2.3 Matrix 2 Format

This format is specific to the Matrix Connection register.

Check Code CC

The check code will occupy 4 bits, 38 to 41 inclusive.

Register Address RA

In order that this message format may be entered by the test box, the register address must be 3 and this will be placed in a three bit field, bits 35 to 37 inclusive.

Data

In this format the data field is restricted to 32 bits and divided into three segments.

i. I/P address

This segment occupies 9 bits, 3 to 11 inclusive.

ii. O/P address

This segment occupies 9 bits, 12 to 2Ø inclusive.

iii. Unused data

The data area occupying bits 21 to 34 inclusive is unused in this format and will always be filled with zeros.

Parity $P_{Ø}$, P_1 and P_2

In this format there are three parity bits:

P_1 occupies bit 1 and covers the I/P address data identified above.

P_2 occupies bit 2 and covers the O/P address data identified above.

$P_{Ø}$ covers Register address, the complete data field and parity bits P_1 and P_2 (as in Figure 3).

All parity bits will be generated automatically by the test box.

3.1.2.4 Parity

In the message formats described in 3.1.2.1 to 3.1.2.3 above, all the parity bits will be generated automatically. An option is included to select either even or odd parity for each message type A or B. If even is selected then all parity bits will generate to form even parity over the fields within the message which they are intended to protect. If odd is selected then, obviously the reverse is true. The inclusion of this option enables the User to investigate the

parity generating and checking mechanisms in the system under test.

3.1.3 Tx Option

The operator can select one of 3 types of transmission. Regardless of which type is selected, when entered it must be followed by a Carriage Return (CR). In both multiple and continuous modes there is a fixed delay between successive O/P transfers. The fixed delay has been set to a specific number of clock periods, 128 or 256, giving a delay of 128 or 256 microseconds. This has been done in order to obtain a jitter-free oscilloscope display.

Types of transmission available are:

Single: The message(s) are transmitted once only.

Continuous: The messages are transmitted an infinite number of times until a stop character is entered to terminate the transmission. The stop character is the letter S followed by carriage return.

Multiple: The message(s) are transmitted a number of times as preset by the User. However, the transmission can be terminated prematurely if wished by entering a stop character via the VDU.

If the multiple transmission mode is selected the test box will return with the prompt "Enter number in DECIAML" and the User should enter the number of transmissions required. The number is in decimal format of a maximum of 5 characters giving a maximum number of 65,535 transmissions. The number entered should, as in all User entries, be terminated with a carriage return.

3.1.4 Wait Condition

When the transmission option has been entered by the User the next function offered is the "WAIT" condition.

This option is only available with Single, Multiple and Continuous transmission options.

If the Wait Option is selected the test box will output a message and wait for an input from a specified Register Address. When the required input has been received the test box will immediately output the next message. This eliminates the fixed delay between outputs mentioned in 3.1.3 above and enables the test box output rate to be determined by the response rate of the system under test.

3.1.5 Display Options

When the Wait Condition selection has been completed the test box will print a series of Display options on the VDU, and also offers the User the choice of having the display in an ON LINE or OFF LINE mode. All input messages are numbered in the order of arrival and this number will be displayed in DECIMAL format with the input message data.

The User may select one of the following options for his display choice:

N = None

A = All

C = Changes

None

No inputs will be displayed. This option is especially useful when the User wishes to use an oscilloscope (or other equipment) to investigate the system under test and is more interested in the fact that output and input transfers are occurring, rather than the actual content of such transfers.

All

Every message input to the test box will be displayed on the VDU or stored for OFF LINE display.

Changes

The data content of input messages is compared to that of the last input message. If the content is the same no action is taken, if changed the message is displayed and the copy of the message kept for comparison is overwritten with the latest message. If the User has selected the option of transmitting two message types A and B then input messages with even message numbers will correspond to response to outputs of type B and inputs with odd message numbers will correspond to responses to outputs of type A. Inputs will only be compared with inputs of the same type to check for changes.

ON LINE

if ON LINE display is selected then whenever an input (satisfying the above criteria for display) is received it will be displayed on the VDU before the next output is sent. This will obviously slow down the rate of output transfers.

FIGURE 4 - TRANSFER TIMES

In the ON LINE display mode the rate of O/P transfers will be determined almost totally by the time taken to actually display the message on the VDU. Messages displayed ON LINE will also be stored and, therefore, available for OFF LINE display.

Figure 4 illustrates typical timing for input and output from the test box where:

to = time for O/P transfer = 42 bits at 1 MHz = 42μs

tr = nominal response time for system under test = 2Øμs

ti = time for I/P transfer = 42 bits at 1 MHz = 42μs

td = nominal time for fixed delay in test box = 256μs

It can be seen that under normal delay conditions an input (or output) transfer could be expected to begin at:

$$ti \text{ (or } to) + td + to \text{ (or } ti) + tr = 42 + 2\emptyset + 256 + 42 = 36\emptyset\mu s$$

This time is short in comparison with the time taken to display a message on the VDU.

Each displayed message consists of approximately 6Ø characters. Each character is transmitted to the VDU in ASCII format of 1Ø bits (8 data + start and stop bits) the transmission rate is 9.6 Kbits/second.

$$tb = \text{time to transmit one bit} = \frac{1}{96\emptyset\emptyset} \text{ seconds}$$

$$\text{time to transmit one line of } 6\emptyset \text{ characters} = \frac{6\emptyset \times 1\emptyset}{96\emptyset\emptyset} \text{ seconds}$$

$$= 62.5 \text{ ms.}$$

It can be seen, therefore, that the User must be prepared to accept a delay of approximately 63 ms between successive outputs in the ON LINE display mode. This overrides the nominal delay between outputs and the wait conditions described in sections 3.1.3 and 3.1.4 above.

If ON LINE display is selected the test box will also require details of the segmentation required for displaying messages, see section 3.2.

If ON LINE display of CHANGES of input messages is selected it is possible that if no change in input message is detected no messages will be displayed on the VDU. In order to satisfy the User that the test sequence is functioning normally he may instruct the test box to display every thousandth input message. If this option is selected by the User the 'comfort' message will be displayed ON LINE but will not be stored for later, OFF LINE, display.

OFF LINE

If the OFF LINE display mode is selected output transmissions can be achieved at intervals determined by either the nominal delay or wait condition previously described. Thus is possible because input messages (either all or changes as specified) are stored for later, OFF LINE, display. Whilst these stored messages are being displayed no inputs or outputs may be processed by the test box.

Storage for 64Ø input messages has been allocated. If the User has selected either the Multiple or Continuous transmission option and this storage area is filled with input messages ready for display then the output and input sequences are terminated in order that the stored information is not overwritten. The message "Terminated. Message store FULL" will be displayed on the VDU informing the User that outputs and inputs have been prematurely terminated and then the basic command mode prompt will be displayed on the VDU.

When the User has completed the display option input the output message(s) will be assembled and ready for transmission.

3.1.6 Ready to Transmit

The prompt "Ready to Transmit? Y for Yes" will now appear. The operator must enter Y or N terminated by a Carriage Return. If the User enters a No command the Basic Command mode prompt will be displayed on the VDU. If the User enters the Yes command output transmission will begin. If the User has selected either the Multiple or Continuous transmission option one further message "YOU MAY TYPE S TO STOP" will be displayed. If the User enters a stop character he will terminate a continuous transmission or prematurely terminate a Multiple transmission (ie before the selected number of outputs is completed).

Whenever a transmission sequence reaches normal termination or is stopped by the User the test box will enter the Basic Command routine and the corresponding prompt will be displayed.

3.2 Display on Request Facilities

Any time the test box is in the basic command mode the User may select the display on request function. This function allows the User to examine the content of the input message store described above. When the function is entered the number of messages and the prompt "Segmentation 1, 2, 3 or 4 or Ø for User settings" will be displayed on the screen.

The input message number (in DECIMAL) is to be displayed with the content of each measage.

3.2.1 Preset Segmentation

The word segmentation is used here to describe the action of splitting the displayed message(s) into groups of bits to make display interpretation easier. Three preset segmentation specifications numbered 1, 2 and 3 are available to the User:

(1) corresponds to a segmentation suitable for GTU messages

(2) corresponds to a segmentation suitable for Matrix status messages

(3) corresponds to a segmentation suitable for Matrix Connection messages.

3.2.2 No Segmentation

Each input message is 42 bits in length. These 42 bits of data will be displayed with the number corresponding to each particular message.

It can be seem from Figure 5 below that without segmentation it would be difficult to identify data areas of interest.

122 ØØ1ØØØ1ØØ1Ø11ØØØØØØØØØ111ØØØØØØØØ1111Ø1111

Message Number — 42 bits of Data

FIGURE 5 - MESSAGE WITH NO SEGMENTATION

3.2.3 Segmentation 1 (GTU)

Segmentation 1 is designed to display a GTU message in the most readable format. The check code, Register address and Parity are easily defined and the data is sectioned into blocks of 8 bits (starting at the least significant bit). This is particularly suited to CDU and TSU input messages. In a CDU message the least significant block of 8 bits is the CPC, and the next block contains the channel address. In a TSU message the least significant two blocks contains the 16 bits of TSU data. Figure 6 below illustrates this segmentation.

122 ØØ1Ø Ø1Ø ØØ 1Ø11ØØØØ ØØØØ111 ØØØØØØCØ 1111Ø111 1

message number	check code / Register address / 2 bits of Data	8 bit Data blocks	Parity 1 bit

FIGURE 6 - MESSAGE WITH SEGMENTATION 1

3.2.4 Segmentation 2 (Matrix Status)

Matrix messages (both status and connection) are only 36 bits in length ar present (this may be modified to 42 bits at a later date). In order to display a Matrix message in the clearest possible manner the segmentation must be different.

Figure 7 below illustrates a typical Matrix Status message.

122 ØØØØØØ ØØØ1 ØØ1 ØØØØØØØØØ111ØØØØØØØ111 1 Ø111 Ø1

Message Number	6 bits unused (for future expansion)	check code	Register address	Data	Parity

FIGURE 7 - MESSAGE WITH SEGMENTATION 2 (MATRIX STATUS)

3.2.5 Segmentation 3 (Matrix Connection)

Matrix connection register inputs are segmented specifically to identify input group and channel and output group and channel. Figure 8 below illustrates a typical Matrix connection register input message.

122 ØØØØØØ ØØØ1 Ø11 ØØØØØØØØ Ø111 ØØØØØ ØØØ1 111Ø1 11Ø

Message Number	6 unused bits	check code	Register address	Group	Channel Group	3 Parity bits

FIGURE 8 - MESSAGE WITH SEGMENTATION 3 (MATRIX CONNECTION)

3.2.6 Automatic Segmentation (Segmentation Choice 4)

If the User wishes he may select Automatic segmentation. In this mode the test box will inspect the received message and select the most appropriate segmentation (sections 3.2.3, 3.2.4 and 3.2.5 above). Segmentation 1 is selected for GTU messages. The input register address defines the choice of segmentation for Matrix messages. Register address 2 corresponds to Matrix status and Register address 3 corresponds to Matrix connection messages.

3.2.7 User Defined Segmentation

If none of the 3 preset segmentations is suitable, for a particular application, a fourth, numb · Ø, is reserved for User definition. If, for example, the User was interested only in bits 23 to 27 of the input messages, he could set segmentation Ø at bits 22 and 27 thus easily identifying the 5 bits 23, 24, 25, 26 and 27. Figure 9 below illustrates this segmentation, up to 7 segmentation spaces can be defined by the User.

122 ØØØØØØØØØ1Ø11ØØØØØØØØØ 11ØØ ØØØØØ111Ø1111Ø

Message Number	Area of Interest

FIGURE 9 - MESSAGE WITH USER DEFINED SEGMENTATION

3.2.8 Block Display

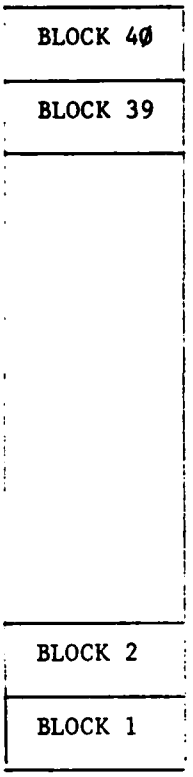
When the segmentation has been selected the User will be invited to enter the number of the message block required to be displayed.

The input message store of 64Ø messages is divided into 4Ø blocks. Each block contains 16 messages, ie approximately one screen full.

Figure 1Ø illustrates the block structure of the input message store.

In response to the prompt "Enter Block Number in DECIMAL" the User should enter a DECIMAL number between 1 and 4Ø. A request to display block Ø will cause the total message store (starting at Block 1) to be displayed.

This function allows the User to examine blocks of input messages in a random order.



BLOCK NUMBERS IN DECIMAL FORMAT

FIGURE 10 - BLOCK STRUCTURE OF INPUT MESSAGE STORE

When an output/input sequence begins the message count is set to zero and the message buffer always fills from block 1. Thus if 43 messages were received blocks 1 and 2 would be full and block 3 would contain 11 messages.

A request to examine blocks 1 or 2 would cause 16 messages to be displayed.

A request to examine block 3 would cause only 11 messages to be displayed.

A request to examine any block number greater than 3 would have no effect since there would be no messages to be displayed, the error message "Block Empty" will be displayed.

On completetion of each display function the best box will display the word "Finished" and return to the Basic Command Routine.

3.3 Auto Display Facilities

The previous two commands have been with the AXIS test box acting as the transmission element, initiating responses from the system under test. As well as this role the AXIS test box must fulfil a second function that

is to accept and display autonomous input transfers from the system. For example, a situation such as this may occur when the operator is sent a message from a subset. In the Auto Display mode the User will have the choice whether to re-define the Display Option (see 3.1.5 above) or use the Display Option already selected. The test box will then respond with "Ready to Receive? Y for Yes" and wait for User input.

When this mode is entered the input message count will be set to zero and messages will fill the input message store starting at block 1.

The User may terminate the Auto Display Mode by entering the Stop Character, otherwise, when the input message store is full the test box will automatically exit from this mode and enter the Basic Command Mode.

3.4 Repeat Facilities

When a message has been assembled but output/input has stopped, for any reason, and the test box is in the Basic Command Mode, the previously specified message may be re-initiated using the repeat command. The repeat command also gives the User the ability to change all of the parameters of the message individually without having to completely re-assemble the message before re-starting the input/output sequence.

The repeat function can only be used after a complete message has been assembled using the Message Assembly routine. If Repeat is entered before a message has been assembled the error message "No Message Assembled" will be displayed and the Basic Command Routine re-started.

3.5 Display Current Menu Facilities

By entering this routine the User can inspect the message parameters selected. The complete message structure is dis-assembled and displayed as individual parameters allowing easy User inspection.

If this routine is entered before a message has been assembled the error message "No Message Assembled" will be displayed and the Basic Command Routine re-started.

4 DATA ENTRY

This section describes the method of entering the information required by the test box. The backspace (CONTROL H) may be used to correct erroneous input. This may be dome before the input is entered, ie before carriage return key is pressed.

In order to distinguish the prompts issued by the test box all test box prompts (in this section of the User guide) will be in quotation marks.

4.1 Command Mode

Whenever the test box is in the Basic Command mode the following prompt will be displayed in the VDU:

"Command A = Assemble Message
B = Display on request
C = Auto Display
D = Repeat
E = Display Current Menu"

The User should enter the letter (A-E) specifying the command required.

4.2 Message Assembly

Annex B illustrates a full example of Message Assembly. The following paragraphs detail Message Assembly input.

4.2.1 Message Type

When the message assembly routine is entered the first prompt displayed will be a request to select Message type. The following prompt will be displayed:

"A = A register
B = B register
T = Both registers"

The User should enter A, B or T to select the message type required.

The test box will then issue the next prompt. If the User has requested the A or Both registers, the prompt will be "Enter input for message A". If the User has requested the B message, the prompt will be "Enter input for message B".

This is not actually a prompt but serves to inform the User which message is being assembled. Selection of message type T will ensure that the prompt "Enter input for message B" appears on the VDU after the requirements for A message have been entered.

4.2.2 "Enter Check Code"

Check code must be entered in hex format and will occupy 4 bits, (one hex character) from bits 38 to 41 inclusive of the message Register (Figure 1).

4.2.3 "Enter Register Address"

Register Address must be entered in hex format also. This will occupy the 3 least significant bits of one hex character from bits 35 to 37 inclusive of the message register (Figure 1).

Register addresses in the range Ø to 7 are valid.

4.2.4 "Enter Data"

All data will be entered in hex format.

All data bits that are not set by the User when data input is requested default to zero. This data input format was designed in this way in order that the User need not enter data for the whole of the data field if he wishes only to set the least significant bits. All data entered by the User is packed into the data field of the message register starting at the least significant bit of the available data field.

ie: starting at bit 1 for a GTU format message

starting at bit 2 for a Matrix Command Register format

starting at bit 3 for a Matrix Connection Register format.

The following 3 examples illustrate this more precisely.

Example 1: GTU Format

If the User entered 25 cr as his data input for this format the result would be as in Figure 11 below.

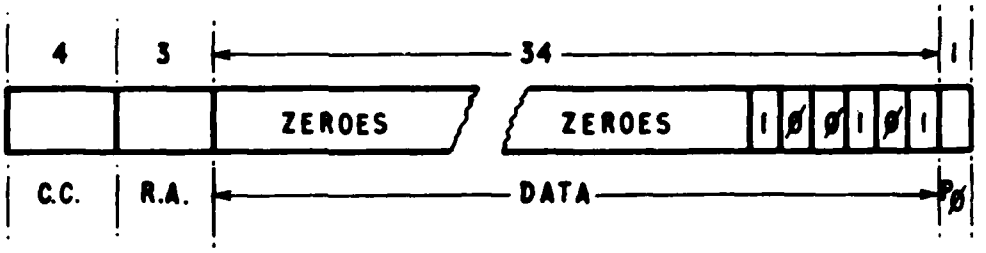


FIGURE 11 - EXAMPLE OF DATA IN GTU FORMAT

Example 2: Matrix Command Register Format

If the User entered 25 cr as his data input for this format the result would be as in Figure 12 below.

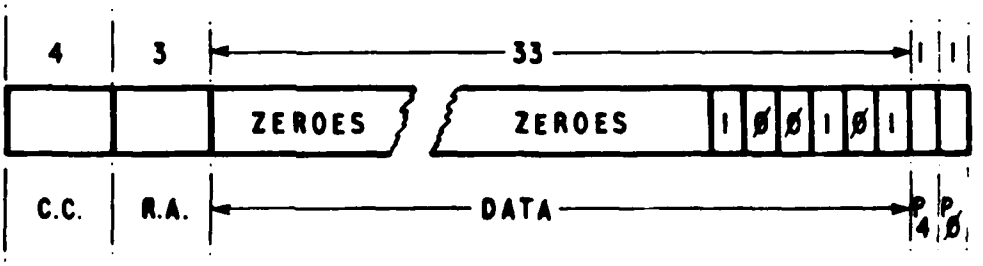


FIGURE 12 - EXAMPLE OF DATA IN A MATRIX COMMAND FORMAT

Example 3: Matrix Connection Register Format

If the User entered 25 cr as his data input for this format the result would be as in Figure 13 below

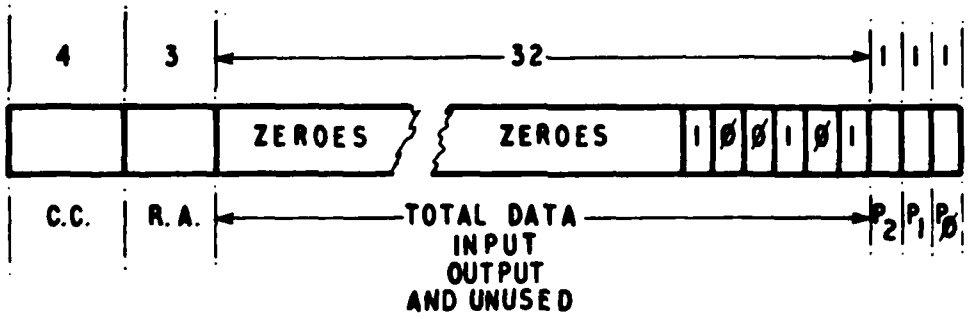


FIGURE 13 - EXAMPLE OF DATA IN MATRIX CONNECTION FORMAT

4.2.5 Parity

The User is given the option to select Even or Odd parity for each message type. The prompt:

"Parity Even? N for No"

will be displayed. If the User enters N then Odd parity will be selected. Any other character entered will select Even parity.

4.2.6 Message Format

The message format may be defined independently for each message A and B.

When the message type is selected the matrix text box will request the Format to be input by issuing the prompt.

"Message format

G = GTU

M1 = Matrix Command

M2 = Matrix Connection"

The User should select the format required by entering the correct letter(s) followed by a carriage return.

If message Type T was selected the VDU will now prompt "Enter input for Message B". This will follow the same format as the A Message and all requirements should be answered in the same fashion as the previous message with all entries terminated by a Carriage Return. If and when the requirements for the B Message have been entered the VDU will then respond with the next prompt for the transmission option.

4.2.7 Transmission Options

When the message register(s) has been filled the next test box prompt will be a request to select the transmission option. The following prompt will be displayed:

"Tx Option: S = Single
C = Continuous
M = Multiple"

The User should enter S, C or M. If the M option is selected the test box will return with the prompt.

"Enter Number in DECIMAL"

The User should enter a number, up to 5 DECIMAL digits, to select the number of transmissions required.

4.2.8 Wait Format

After Tx option selection has been completed the test box will return with the prompt "Wait Y or N". If the YES (Y) option is entered by the User the test box will respond with the prompt "Enter Wait RA". The User should then enter a single hex character, being the Register Address upon which the test box should wait. (This last step will be omitted if the User entered No (N) to the "Wait Y or N" prompt).

4.2.9 Display Options

The next prompt displayed will be:

"Display Options: N = None
A = All
C = Changes"

The User should enter A, N or C to select the display option required. If either the A or C option is selected the test box will return with the prompt:

"Display ON LINE Y or N?"

The User should enter Y for YES or N for NO to select ON or OFF LINE display respectively.

If the User has selected ON LINE display the test box will request segmentation instructions for the display format required (see sections 3.2.1 and 4.3.1) by issuing the prompt:

"Segmentation 1, 2, 3 or 4,or Ø for User settings"

The User should enter 1,2,3,4 or Ø to select the required segmentation pattern.

If at this point the User had selected the following options:

a. Continuous or Multiple (over 1ØØØ transfers)

b. Changes

c. ON LINE display

the test box will issue the following prompt:

"Display every thousandth input message? Y for YES"

Entering Y for Yes will enable the 'comfort' messages. Entering any character other than Y will disable the 'comfort' messages.

4.2.1Ø Ready to Transmit

Finally the test box will issue the prompt:

"Ready to transmit? Y for Yes"

The User should enter Y of he is ready for transmissions to begin. Entering N will return command to the basic command mode routine.

When the User has entered a Y to the "Ready to transmit" prompt, if either the M or C transmission mode had been selected a final piece of information:

"You may type S to Stop"

will be displayed before transmissions begin.

4.3 Display on Request

When the Display on Request routine is entered the number of messages stored for display will be printed on the VDU Screen in the form "XXX Messages" this will be followed by the request for display segmentation. "Segmentation 1, 2, 3 or 4 or Ø for User settings". (XXX is the number Ø-64Ø of messages stored and available for display).

4.3.1 Segmentation Specification

The User should enter the segmentation number required. If the User enters 1, 2, 3 or 4 the next step will be 4.3.3. If the User enters Ø the following prompt message will be displayed "Change the existing segmentation? Y for Yes". If the User wishes to change the settings he should enter Y. If the User enters any other character 4.3.3 will be the next step.

4.3.2 User Settings

The following information will be displayed on the VDU:

"You may enter up to 7 segmentation spaces. Enter DECIMAL number of bit after which you want space. Input on request. Terminate input with E".

The test box will then issue a request for the bit position of the space(s) to be entered.

"Enter Number"

The User should enter a DECIMAL number followed by a carriage return. The prompt will then be re-issued. The User may enter up to 7 segmentation spaces. When the User has entered the segmentation space bit numbers he requires, he should input the character E followed by carriage return in response to the "Enter Number" prompt.

4.3.3 Block Display

At this point the test box will issue the prompt "Enter Block Number in DECIMAL".

The User should enter a decimal number between 1 and 4Ø corresponding to the block he requires to be displayed. The User should remember that the number of stored messages has already been indicated and that each block contains 16 messages.

If the User enters Ø then all the messages stored will be displayed, starting at block 1. If the User enters a number greater than 4Ø the error message "Block out of Bounds" will be displayed and the Basic Command Routine re-started.

On completion of display, the 'comfort' message "Finished" will be displayed and the Basic Command Routine will be re-started.

4.4 Auto Display

After entering C when in the Basic Command Mode (see 4.1 above) the User will be invited to choose whether or not to change the existing Display Option. The test box will issue the prompt "Do you wish to change ANY of the display options? N for NO". Display Option selection is detailed in 4.2.9 above. In Auto Display Mode the option to display 'comfort' messages is always available to the User if he has selected to display ON LINE changes of message. After this selection the message "You may type S to stop" will be displayed. The User may exit auto display mode by entering the stop character.

4.5 Repeat

After entering D when in the Basic Command Mode the Repeat routine will be entered. If no message had previously been assembled the error message "No message assembled" will be displayed and control returned to the Basic Command routine. The Repeat routine allows the User to change individual parameters of the assembled message. On entering the Repeat routine the current Menu will be displayed for User convenience.

The information message "Options are A, B, T, O, W, Y, Q, M, S and G" will be displayed, indicating the options available to change the parameters.

4.5.1 Change Options

The User should enter the letter corresponding to the parameter to

be changed. These are identified below:

4.5.1.1 A

This option allows the User to change parameters of the A message. A second parameter is required to define the particular A message parameter to be changed. The choice is R for Register Address, C for Check Code, D for Data and P for Parity and F for Format. This second parameter may be entered immediately with the A option, ie enter AC, AR, AD, AP or AF or if the User was to enter A alone he would be invited to enter the second parameter. The test box would issue the prompt:

"Enter 2nd Parameter
Options are C, R, D, P and F"

The User may then enter his choice of second parameter.

4.5.1.1.1 AC

This allows changes to the A message check code.
Proceed as in 4.2.2.

4.5.1.1.2 AR

This allows changes to the Register address of the A message.
Proceed as in 4.2.3.

4.5.1.1.3 AD

This allows changes to the Data of the A message.
Proceed as in 4.2.4.

4.5.1.1.4 AP

This allows the User to select ODD or EVEN parity for the A message. Proceed as in 4.2.5.

4.5.1.1.5 AF

This allows the User to select the message Format required for transmission of the output message(s).
Proceed as in 4.2.6.

4.5.1.2 B

This option allows the User to change the individual parameters of the B message. The method of use is defined in 4.5.1.1 above.

4.5.1.3 T

This option allows the User to change the message Type: A message, B message or both Together. Proceed as in 4.2.1.

4.5.1.4 O

This option enables changes to the transmission Option to be made. Single, Continuous or Multiple. Proceed as in 4.2.7.

4.5.1.5 W

This option allows the User the choice to re-define the Wait format. Proceed as in 4.2.8.

4.5.1.6 Y

This option is included to allow changes to the displaY options: None, All or Changes. Proceed as in 4.2.9.

4.5.1.7 Q

This option, Quit, is included to enable the User to re-enter the Basic Command Mode from the Repeat routine.

4.5.1.8 M

This option, Menu, allows the User to display the current Menu, incorporating changes he may have just made, without having to Quit and display the Menu via the Basic Command Mode.

4.5.1.9 S

This option allows the User to select the Segmentation required without having to completely re-select the display options. Proceed as in description of segmentation in 4.2.9.

4.5.1.10 G

By using the Go option, the User may re-start transmission of the newly modified messages.

4.6 Display Current Menu

Entering the character E when in the Basic Command Mode will cause the current User specified menu to be displayed. Annex C gives an illustration of the menu displayed which would result from the Message Assembly example given in Annex B.

5 STOPPING A SEQUENCE

The test box is designed to allow the user to terminate a sequence, whether it be input or output, at will.

5.1 Outputs

If the User selects Single or Multiple transmission options the output sequence will terminate when the selected number of output transmissions has been sent.

If however, the User selects Continuous transmission option, outputs will continue until stopped by the User entering the stop character, (the letter "S" followed by carriage return).

In Multiple mode the User may prematurely terminate the output sequence before the selected number of output transmissions has been reached.

5.2 Inputs

In Auto Display Mode the test box is programmed to accept Continuous input transfers until the sequence is terminated by the User entering the stop character.

5.3 Termination by User

When the User enters the stop character to terminate an output sequence this could happen at any point during an input or output transfer. In order to maintain synchronisation with the system under test, and avoid stopping in the middle of an output or input transfer, the test box will send one extra output and expect a 'handshake' input from the external device before terminating the sequence finally.

When the User enters the stop character to terminate an Auto Display (input only) sequence the test box will terminate the sequence after the next input transfer.

When the stop character is entered the test box will respond by printing:

"Terminated by User Intervention"

to confirm the User stop instruction.

5.4 Normal Termination

The event which causes normal termination is the reception of a valid input transfer. Under these circumstances the test box will print:

"Normal termination after input"

before restarting the Basic Command Routine.

5.5 Wait Termination

If the User has selected to Wait for a specific Register Address on inputs and the 'final' input transfer does not have the specified Wait Register Address the test box will print:

"Terminated after bad wait"

before entering the Basic Command Routine.

5.6 Time Out

When a sequence is terminated the test box will enable a 'time out'. If an input transfer is not reveived before this time out period expires the test box will print:

"Terminated. Input TIMED OUT"

and pass control to the Basic Command Routine.

5.7 Store Full

Memory space for the storage of 64Ø inputs for later OFF LINE display has been allocated to the test box. If this memory space is filled by stored input transfers the test box will automatically terminate the sequence and print:

"Terminated. Message store FULL"

and then enter the Basic Command Routine.

REFERENCES

1 Plessey Manual 652/SJ/Ø1243, Section 2, Signalling Format.

2 Monitors for the M68ØØ and M68Ø9 Microprocessors, (RSRE Memorandum No 344Ø), A L Simcock

3 Introduction to the AXIS Test Box, A L Simcock.

ANNEX A

QUICK REFERENCE GUIDE TO USER RESPONSES

All User Responses Terminated by Carriage Return

PROMPT		USER RESPONSE
	BASIC COMMAND MODE	
Command	A = Assemble Message	
	B = Display on Request	
	C = Auto Display	A, B, C, D or E
	D = Repeat	
	E = Display Current Menu	
	MESSAGE ASSEMBLY	
Message Assembly Mode		
	A = A Register	
	B = B Register	A, B or T
	T = Both	
	Enter input for message A (or B)	
	Enter Check Code	1 Hex Digit
	Enter Register Address	1 Hex Digit
	Enter Data up to 9 HEX digits	Up to 9 Hex Digits
	Parity EVEN? N for No	N to choose ODD parity any other character to choose EVEN parity
Message Format		
	G = GTU	
	M1 = Matrix	G, M1 or M2
	M2 = Matrix Connection	

NOTE: The above will be repeated for B Message if the T option is selected.

Entering more than the required number of characters will cause the "overflow" error message to be displayed.

PROMPT	USER RESPONSE
Tx Option S = Single C = Continuous M = Multiple	S, C or M
NOTE: If M option selected extra prompt	
Enter Number in DECIMAL	Up to 5 DECIMAL Digits (M ≤ 65,535)
Wait Y or N?	Y or N
NOTE: If Y option selected extra prompt	
Enter Wait RA	1 Hex Digit
Display Options N = None A = All C = Changes	N, A or C
NOTE: If A or C option selected extra prompt	
Display ON LINE Y or N?	Y or N
NOTE: If ON LINE selected extra prompt	
Segmentation 1, 2, 3 or 4 or Ø for User settings	1, 2, 3, 4 or Ø
NOTE: If Changes, ON LINE and Continuous or Multiple greater than 1ØØØ selected extra prompt	
Display every thousandth input message? Y for YES	Y for YES any other character for NO
Ready to Transmit? Y for YES	Y for YES any other character for NO
You may type S to Stop	S (optional response)

PROMPT	USER RESPONSE
DISPLAY ON REQUEST MODE	
Display on Request Mode 2 Messages	
Segmentation 1, 2, 3 or 4 or Ø for User settings	Ø for User settings 1, 2 or 3 for prests 4 for Automatic
Change the existing segmentation? Y for Yes	Y for Yes Anything for No
You may enter up to 7 segmentation spaces Enter DECIMAL number of bits after which you want space Input on request, Terminate input with E	
Enter Number	1 or 2 DECIMAL digits Terminate with E
Enter Block Number in DECIMAL	1 or 2 DECIMAL digits
AUTO DISPLAY MODE	
Auto Display Mode	
Display Options N = None A = All C = Changes	N, A or C
NOTE: If ON LINE display selected Segmentation choice available If ON LINE and Changes selected 'comfort' messages choice available	
Ready to Receive? Y for Yes	Y to accept I/P
You may type S to Stop	S (optional response)

PROMPT	USER RESPONSE

REPEAT MODE

Repeat Mode

NOTE: Current Menu will be displayed. For example see Annex C

Options are A, B, T, O, W, Y, Q, M, S and G	1 or 2 characters
Enter 2nd Parameter	
Options are C, R, D, P and F	1 character

ANNEX B

NOTE: User inputs are underlined for clarity

EXMAPLE OF TYPICAL MESSAGE ASSEMBLY

This is the AXIS test box

Command A = Assemble message
B = Display on request
C = Auto display
D = Repeat
E = Display current menu

A

Message assembly mode

A = A register
B = B register
T = BOTH

T

Enter input for message A

Enter Check Code 1

Enter Register Address 1

Enter Data, up to 9 HEX digits 2Ø

Parity EVEN? N for No Y

Message format

G = GTU
M1 = Matrix Command
M2 = Matrix Connection

M1
Enter input for message B

Enter Check Code 1

Enter Register Address 3

Enter Data up to 9 HEX digits 4221

Parity EVEN? N for No Y

Message format

G = GTU

M1 = Matrix Command

M2 = Matrix Connection

M2

Tx option

S = Single

C = Continuous

M = Multiple

M

Enter number in DECIMAL 1234

Wait Y or N? Y

Enter wait RA 2

Display options

N = None

A = All

C = Changes

C

Display ON LINE Y or N? Y

Segmentation 1, 2, 3 or 4 or Ø for User settings 4

Display every thousandth input message? Y for YES Y

Ready to transmit Y for Yes Y

You may type S to stop

S

Terminated by User intervention

Terminated after normal input

Command A = Assemble message

B = Display on request

C = Auto display

D = Repeat

E = Display current menu

ANNEX C

EXAMPLE OF DISPLAY CURRENT MENU

```
Command  A  =  Assemble message
         B  =  Display on request
         C  =  Auto display
         D  =  Repeat
         E  =  Display current menu

E

message Type BOTH
          content of "A" message is
Check code         =  Ø1
Register address   =  Ø1
Data               =  ØØ ØØ ØØ ØØ 2Ø
Parity EVEN        Format type MATRIX 1
          content of "B" message is
Check code         =  Ø1
Register address   =  Ø3
Data               =  ØØ ØØ ØØ 42 21
Parity EVEN        Format type MATRIX 2
transmission Option MULTIPLE, Number of outputs in DECIMAL  =  1234
Wait for input register YES  input Wait RA  =  Ø2
displaY option chosen CHANGES
displaY inputs ON LINE
segmentation chosen is for AUTOMATIC  Input dependent
comfort messages every 1ØØØ inputs ENABLED
Command  A  =  Assemble message
         B  =  Display on request
         C  =  Auto display
         D  =  Repeat
         E  =  Display current menu
```

ANNEX D

USING THE TEST BOX WITH THE ALS M68Ø9 MONITOR

The test box has been designed to run under the control of one version of the ALS M68Ø9 MONITOR program. The test box software is stored in Programmable Read only Memory and the start address of the text box program is CØØØ (hexadecimal).

Pressing the reset button on the microprocessor board will cause the words 'ALS MONITOR SPECIAL V1.0' to be displayed. To prepare for running the test box software it is first necessary to pre-set the start address of the test box program. Proceed as follows:

a. Type X P ▽ CØØØ

b. The Monitor will respond by printing all the microprocessor registers

c. Type G

d. The Monitor will pass control to the test box software

The test box program accesses several MONITOR inout and output routines, for a full description of these and other monitor facilities see ref 2.

▽ This symbol is used to represent the space character on the VDU keyboard.